Center Innovation Fund: JSC CIF

Development of Novel Particle Impact Tester for Oxygen Rich Turbo Machinery Materials and Coating Evaluation

Completed Technology Project (2017 - 2018)

Project Introduction

The need to develop a test system that can validate material choices in relevant environments is crucial to making robust high performance engine designs, and decrease risk. With this project we propose a ignition test bed capable of providing relevant test conditions (Pressure, Temperature, Velocity, Concentration). A modular subscale oxygen rich preburner based particle impact test system would provide the opportunity to create relevant ox rich environments with various fuels (RP1, Hydrogen, Methane, CNG) with LOX, encompassing the current design envelops of many development projects. A modular design would allow great flexibility not only in environmental the conditions used for testing mixed gas, but also with 100% oxygen testing as well. For example a heat exchanger module could allow for heating LOX, up to high pressure/ high temperature GOx for testing other 100% oxygen engine component candidate materials at conditions that exceed current test capabilities.

Anticipated Benefits

This technology will enhance the understanding of various alloy and material performance in high-temperature, high-pressure oxygen environments. Such information will enable deep-space human exploration by aiding in the advancement of state-of-the-art rocket engines and support the development of optimized materials for extreme oxidizing conditions.

Primary U.S. Work Locations and Key Partners

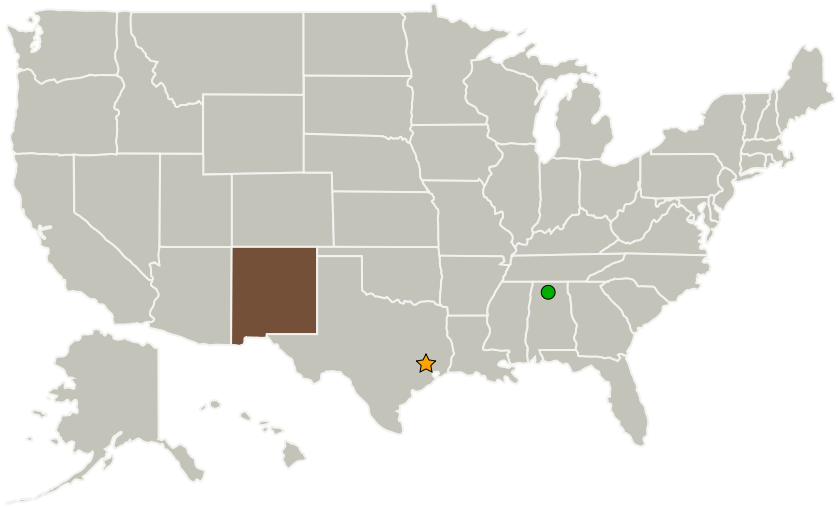

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Table of Contents

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Organizations Performing Work	Role	Type	Location
Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Aerojet Rocketdyne Holdings, Inc.	Supporting Organization	Industry	El Segundo, California
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
New Mexico

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: A detailed feasibility study was conducted to determine st ate-of-the-art technology to heat and pressurize oxygen and to propose the dev elopment of a next generation particle impact ignition testing apparatus with an expanded testing envelope (pressure, temperature, velocity). By utilizing special ized components and materials, an achievable methodology has been identified f or the pressurization and heating of oxygen to steady-state flowing conditions in excess of 14,000 psi and 1300 °F for evaluating the resistance to ignition and co mbustion of materials and components. This expanded test envelope will enable NASA and commercial partners to support current and future industry demands to evaluate material choices in increasingly hazardous oxygen environments.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

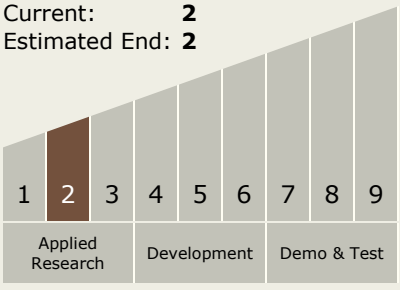
Carlos H Westhelle

Principal Investigator:

Jonathan M Tylka

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destination

Earth

Supported Mission Type

Push